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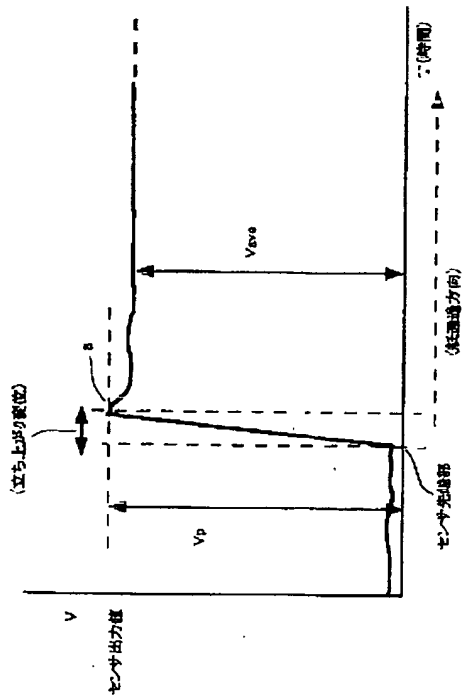
(54)【発明の名称】　紙厚検知装置

(57)【要約】
【課題】用紙の紙厚だけでなく用紙の先端検出機能を持たせることにより紙厚センサと先端センサを兼用させ得る紙厚検知装置を提供する。
【解決手段】用紙を挟んで搬送する搬送ローラ対２５１のローラ間隔を検出して紙厚を検知する紙厚センサ４００と、用紙先端が前記搬送ローラ対２５１に触れたときに発生する紙厚センサ４００の出力状態から用紙の先端を判別する先端判別手段３０２と、を備えたことを特徴とする。



【特許請求の範囲】
【請求項１】用紙を挟んで搬送する搬送ローラ対のローラ間隔を検出して紙厚を検知する紙厚センサと、
用紙先端が前記搬送ローラ対に触れたときに発生する前記紙厚センサの出力状態から用紙の先端を判別する先端判別手段と、を備えたことを特徴とする紙厚検知装置。
【請求項２】先端判別手段は、前記紙厚センサの出力状態として出力の変位度あるいはオーバーシュートを読みとって用紙の先端を判別することを特徴とする請求項１に記載の紙厚検知装置。
【請求項３】先端判別手段は、前記紙厚センサの出力状態として前記センサの出力レベルの定常状態に移行した瞬間を読み取って用紙の先端を判別することを特徴とする請求項１に記載の紙厚検知装置。
【請求項４】紙厚センサとして固定コアと可動コアの距離によって相互インダクタンスが変化して出力が変化する同調方式のセンサが用いられ、前記可動コアを搬送ローラ対のローラ間隔の変化に連動して変位させる連動手段を備えていることを特徴とする請求項１乃至３のいずれかの項に記載の紙厚検知装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は今後画像形成装置などに採用されるであろう紙厚等を検知するための紙厚検知装置に関するものである。
【０００２】
【従来の技術】従来、この種の紙厚センサは紙厚を検知する機能のみの構成をとっていた。
【０００３】
【発明が解決しようとする課題】しかしながら、上記従来例では紙厚センサが追加される分、コストアップ要因および、取り付け場所の確保の困難さが増してくる。
【０００４】本発明は上記した従来技術の問題を解決するためになされたもので、その目的とするところは、用紙の紙厚だけでなく用紙の先端検出機能を持たせることにより紙厚センサと先端センサを兼用させ得る紙厚検知装置を提供し、コストダウンおよび省スペース化を図ることにある。
【０００５】
【課題を解決するための手段】上記目的を達成するために本発明によれば、用紙を挟んで搬送する搬送ローラ対のローラ間隔を検出して紙厚を検知する紙厚センサと、用紙先端が前記搬送ローラ対に触れたときに発生する前記紙厚センサの出力状態から用紙の先端を判別する先端判別手段と、を備えたことを特徴とする。
【０００６】すなわち、紙厚センサを用紙先端が通過した瞬間に発生するセンサ取り付け支持部材の反動等により発生するセンサ出力値の変位度やオーバーシュート、あるいは出力レベルの定常状態に収束する収束時間の安定性を利用することにより、紙厚だけでなく用紙の先端を検知する機能を持たせたものである。
【０００７】紙厚センサとしては固定コアと可動コアの距離によって相互インダクタンスが変化して出力が変化する同調方式のセンサを用い、可動コアを搬送ローラ対のローラ間隔の変化に連動して変位させる連動手段を備える構成とすることが好適である。
【０００８】
【発明の実施の形態】以下に本発明を図示の実施の形態に基づいて詳細に説明する。
【０００９】（実施の形態１）図１は、本発明の実施の形態１の紙厚検知装置が用いられるプリンタコントローラ１０３およびプリンタエンジン１０４を含む画像形成装置としてのプリンタ２００のブロック図を示している。
【００１０】図中、１０１はディスプレイ、１０２はホストコンピュータである。１０３はプリンタコントローラであり、ホストコンピュータ１０２から送信された画像データをラスタスキャンできるように画像信号に変換したり、プリンタエンジン１０４をインタフェースを通じて制御する。プリンタコントローラ１０３とプリンタエンジン１０４は、共に同じプリンタ筐体に収められている。
【００１１】プリンタコントローラ１０３内の各部は以下の通りである。
【００１２】１０３ａはプリンタ筐体表面に配置される表示部、１０３ｂもプリンタ筐体表面に配置される操作部、１０３ｃはコントローラＣＰＵ、１０３ｄはＣＰＵ１０３ｃ内のＲＯＭ、１０３ｅはＣＰＵ１０３ｃ内のＲＡＭである。
【００１３】図２はプリンタ２００の機械構成図である。
【００１４】このプリンタ２００は、本体部分であるプリンタ本体２０１と、オプションであるオプション給紙装置２０２とから構成されている。
【００１５】２０３は前カバーであり、これを開くと手差し給紙トレイであるＭＰＴ（Multi-Purpose Tray）２０４を使用できる。２０５は上記手差し給紙トレイ（ＭＰＴ）２０４上の用紙有りを検知するセンサのフラグである。２０６は手差し給紙トレイ（ＭＰＴ）２０４上の用紙をプリンタ内部に搬送するための給紙ローラである。
【００１６】２０７は標準給紙トレイであるＰＣＴ(Paper Cassette Tray) である。２０８は標準給紙トレイ（ＰＣＴ）２０７上の用紙有りを検知するセンサのフラグである。２０９は標準給紙トレイ（ＰＣＴ）２０７上の用紙をプリンタ内部に搬送するための給紙ローラである。
【００１７】２１０はオプション給紙トレイであるＯＰＴ(Optional Paper cassette Tray)である。２１１はオプショントレイ（ＯＰＴ）２１０上の用紙有りを検知す

るセンサのフラグである。２１２はオプショントレイ（ＯＰＴ）２１０上の用紙をプリンタ内部に搬送するためのＯＰＴ給紙ローラである。

【００１８】２１３は標準給紙トレイ（ＰＣＴ）２０７およびオプション給紙トレイ（ＯＰＴ）２１０から給紙された用紙をさらにプリンタ内部へと搬送するためのローラである。

【００１９】手差し給紙トレイ（ＭＰＴ）２０４，標準給紙トレイ（ＰＣＴ）２０７，オプション給紙トレイ（ＯＰＴ）２１０いずれかから給紙された用紙はレジストシャッタ２１４に先端を当接して、搬送の向きを矯正される。さらにレジストローラ対２１５の駆動により、用紙はさらに後方に搬送される。用紙はさらに、搬送ガイド２１６によって感光ドラム２１９と転写ローラ２２１とによって挟まれる転写ニップへと導かれる。

【００２０】２１７は、周知のトナーカートリッジであり、一次帯電ローラ２１８、感光ドラム２１９、現像シリンダ２２０を内部に備える。

【００２１】静電潜像の書き込みは、スキャナユニット２２２内において、所定のレーザ光をモータ２２３により回転駆動されるポリゴンミラー２２４に照射し、折り返しミラー２２５により感光ドラム２１９へ照射することによりなされる。

【００２２】用紙は、トナー転写位置を過ぎた後、搬送ベルト機構２２６ａ～２２６ｅにより、定着ローラ２２７と加圧ローラ２２８よりなる定着器に搬送され、ここで、トナー画像が用紙に定着される。

【００２３】２２９は排紙センサであり、定着器直後の用紙の存在を検出する。

【００２４】定着器を通過した用紙はさらに排紙ローラ２３０により搬送される。フェイスアップトレイ２３１が図のように開いていると、用紙はトレイ２３１上に積載される。また、トレイ２３１が閉じていると、用紙はローラ２３２に達し、フェイスダウントレイ２３３上に積載される。

【００２５】２３４は上ドアであり、これを上方向に開くとトナーカートリッジ２１７の出し入れができる。

【００２６】図３は、実施の形態１のプリンタエンジン１０４の電気構成図である。

【００２７】３０１はプリンタエンジン１０４の電気回路ユニットである。３０２はマイクロプロセッサであり、３０３はそのコアである。マイクロプロセッサ３０２は、コア３０３内部に設けられるＣＰＵ３０４、ＲＯＭ３０５、ＲＡＭ３０６と、コア３０３と接続されるゲートアレイ(Gate Array)（以下ＧＡと略す）３０７ａ～３０７ｄを備えている。

【００２８】３０８は手差し給紙トレイ（ＭＰＴ）２０４の用紙有りセンサ、３０９は手差し給紙トレイ（ＭＰＴ）２０４の給紙ローラ駆動ソレノイド、３１０は標準給紙トレイ（ＰＣＴ）２０７の用紙有りセンサ、３１１は標準給紙トレイ（ＰＣＴ）２０７の給紙ローラ駆動ソレノイド、３１２はオプション給紙トレイ（ＯＰＴ）２１０の用紙有りセンサ、３１３はオプション給紙トレイ（ＯＰＴ）２１０の給紙ローラ駆動ソレノイド、３３０はレジスト前センサ、３３１はレジストローラ駆動ソレノイドである。それぞれのローラはメインモータ３１４の回転中に、ソレノイドを駆動することにより回転する。

【００２９】３１５は用紙の紙厚を検知する紙厚検知回路、３１６は用紙がプリンタから排紙されたことを検知するための排紙センサである。

【００３０】３１７はオプション給紙装置と排他的にプリンタ本体に接続されるチェッカとのインタフェースである。このチェッカはサービス担当者がプリンタの状況確認や所定操作のために使用される。

【００３１】３１８はプリンタの動作確認のためにテスト画像を出力させるためのテストプリント指示のためのスイッチである。３１９はドア２３４の開閉状態を検知し、また開状態ではプリンタ内部の高圧回路をオフするためのスイッチである。３２０は当プリンタの電源のタイプを指示するジャンパである。

【００３２】３２１はプリンタエンジン１０４がプリンタコントローラ１０３と通信するための外部インタフェース回路である。３２２はスキャナユニット２２２の電気回路、３２３は帯電，現像，転写，定着フィルムの高圧を制御する電気回路、３２４は定着器の電気回路である。

【００３３】３２５はプリンタ内部を冷却するためのファンである。

【００３４】３２６は用紙の搬送ガイド２１６、搬送ベルト２２６ａ～２２６ｅ等の搬送部材であり、３２７は搬送ガイド２１６の電位をマイクロプロセッサのコア３０３に入力するための入力回路である。

【００３５】プリンタエンジン１０４は、外部インタフェース（Ｉ／Ｆ）を通じてコントローラ１０３に対して、／ＢＤＯに載せてＢＤ信号を出力する。これはポリゴンミラー２２４が所定位相であることを示す信号であるが、各用紙に対して画像形成動作を行うとき、１フレームの画像をＶＤＯ，／ＶＤＯを通じてラスタ状に受信するとき、水平走査線の同期信号である。また、各フレームに対する最初のＢＤ信号をＴＯＰ信号と呼んでいる。

【００３６】図４は、本実施の形態１のプリンタにおける紙厚検知装置の構成を示している。同図は、用紙を挟んで搬送する搬送ローラ対としてのレジストローラ対２１５に、用紙Ｓが紙面右から進入してきたところを示すもので、レジストローラ対２１５のローラ間隔を検出して紙厚を検知する紙厚センサ４００と、用紙先端がレジストローラ対２１５に触れたときに発生する前記紙厚センサ４００の出力状態から用紙Ｓの先端を判別する先端

判別手段としてのマイクロプロセッサ３０２、を備えている。

【００３７】紙厚センサ４００としては、固定コア４０４ｂと可動コア４０４ａの距離によって相互インダクタンスが変化して出力が変化する同調方式のセンサが用いられ、前記可動コア４０４ａをレジストローラ対２１５のローラ間隔の変化に連動して変位させる連動手段としての支持部材４０２を備えている。この支持部材４０２は回転軸４０１に回転自在に支持され、その一端にレジストローラ対２１５の一方のローラが支持され、他端に可動コア４０４ａが支持されている。

【００３８】上記トランス４０４は、可動コア４０４ａと固定コア４０４ｂとによって１次巻線４０４ｃと２次巻線４０４ｄとを共有する一つのコアを形成している。可動コア４０４ａと固定コア４０４ｂとの距離により、１次巻線４０４ｃと２次巻線４０４ｄとの間の相互インダクタンスが定まる。

【００３９】用紙Ｓが進入すると、用紙Ｓの厚さ分だけレジストローラ対２１５の下側のローラが下がり、回転軸４０１を中心に支持部材４０２が紙面時計方向に回転する。この支持部材４０２は、ばね機構４０３によって紙面反時計方向に付勢され、レジストローラ対２１５が当接する方向に付勢されている。

【００４０】図５は、図４の説明にある紙厚検知装置の内部回路である。以下に同回路における説明をする。

【００４１】図５において、５０１は１次巻線４０４ｃに常に印加している発振器であり、１次側巻線に４０４ｃに電流が流れることで発振する。一方で、フライトコア４０４ａと４０４ｂとの距離Ｄに応じてコイル４０４の相互インダクタンスが決定され、これに応じて２次側巻線４０４ｄに発生する交流パルス値が決定される。例えば、Ｄの距離が短いと前記交流パルス電圧値であるＬが低くなり、逆にＤの距離が大きくなるとＬの値が高くなるという関係になっている。また、Ｄ（距離）とＬ（電圧値）との関係はほぼ線形性が保たれている。

【００４２】そしてこの交流パルス値のピーク値Ｌを検波回路５０２によって波形整形し直流電圧値に変換し、その出力を増幅器５０３にてＮ倍に増幅させ、この出力値（Ｌ・Ｎ）を最終的な紙厚の出力情報とするのである。

【００４３】以上に述べた紙厚センサ４００が搭載されている構成の装置において、図６のシーケンス図および図８のフローチャート図を用いて説明する。

【００４４】印字制御命令が送られ印字制御が開始されると、各種給紙トレイＭＰＴ２０４，ＰＣＴ２０７，ＯＰＴ２１０に入っている用紙が各給紙ローラ２０６，２０９，２１２により給紙され、さらに搬送ローラ２１３により搬送されレジストシャッタにより用紙の向きが矯正される（８０１）。

【００４５】そして、用紙の先端がレジストローラ対２１５に触れると、前記レジストローラ対２１５の両端が瞬時に広がり、回転軸４０１を中心に支持部材４０２が反時計方向に瞬時に動き、先端に取り付けられている可動コア４０４ａが固定コア４０４ｂから遠ざかる（８０２）。

【００４６】この瞬間、紙厚センサの出力（５０３）において図６で示された立ち上がり時の変位やａ点のようなオーバーシュートが発生してピーク値（Ｖｐ）を検出する（８０３）。さらには、この時のこの検出された変位度も観測する（８０４）。

【００４７】そして、立ち上がりの変位度の時間をＣＰＵ３０２で読み取り、ピーク値（Ｖｐ）を紙厚検知回路３１５の電圧値をＣＰＵ３０２内に搭載されているＡ／Ｄコンバータ３０３内に取り込むことで、前記ＣＰＵ３０２はこれらの情報をもとに用紙の先端検知信号として判別するのである（８０５）。

【００４８】そして続けて搬送されると紙厚センサ４００の出力値が減衰しながら（８０６）、出力値が定常値（Vave）に安定する（８０７）。

【００４９】（実施の形態２）図１～図５に述べた紙厚センサ４００が搭載されている構成の装置において、実施の形態２について図７のシーケンス図および図９のフローチャート図を用いて説明する。

【００５０】この実施の形態２では、先端判別手段としてのＣＰＵ３０２は、前記紙厚センサ４００の出力状態としてセンサの出力レベルの定常状態に移行した瞬間を読み取って用紙の先端を判別するようにしたものである。

【００５１】すなわち、印字制御命令が送られ、印字制御が開始されると各種給紙トレイＭＰＴ２０４，ＰＣＴ２０７，ＯＰＴ２１０に入っている用紙が各給紙ローラ２０６，２０９，２１２により給紙され、さらに搬送ローラ２１３により搬送されレジストシャッタにより紙に向きを矯正される（９０１）。

【００５２】そして、紙の先端がレジストローラ対２１５に触れると、前記レジストローラ対２１５の両端が瞬時に広がり、回転軸４０１を中心に指示部材４０２が半時計方向に瞬時に動き、先端に取り付けられている可動コア４０４ａが固定コア４０４ｂから遠ざかる（９０２）。

【００５３】この瞬間、センサの出力（５０３）において図７で示されたａ点のようなオーバーシュートが発生し、そして続けて搬送されると一定時間後（Δave）には出力値が定常値（Vave）に安定する（９０３）。

【００５４】この定常値に安定した時の紙厚検知回路３１５の電圧値５０３をＣＰＵ３０２内に搭載されているＡ／Ｄコンバータ３０３内に取り込む。このΔave に到達（収束）するまでの時間はほぼ一定となるので、ＣＰＵ３０２は収束してからΔave 分の時間をさかのぼり用紙の先端位置として判別する（９０４）ことで用紙の先

端位置がトランス４０４を通過するシーケンスを推測するのである。

【００５５】

【発明の効果】以上説明したように、本発明によれば、紙厚センサを用紙が通過した瞬間に発生するセンサ取り付け支持部材の反動等により発生するセンサ出力値の立ち上がり時の変位度やオーバーシュートや、定常値に収束する収束時間の安定性といった出力状態を利用することにより紙の先端を検知するように構成したので、紙厚検知センサー一つで先端検知センサを兼用することができ、コストダウンおよびセンサの取り付け場所の省スペース化の実現が可能となる。

【図面の簡単な説明】

【図１】本発明の実施の形態１に係るプリンタコントローラおよびプリンタエンジンを含む画像形成装置としてのプリンタシステムのブロック図である。

【図２】実施の形態１のプリンタエンジンの機械構成図である。

【図３】実施の形態１のプリンタエンジンの電気構成図である。

【図４】実施の形態１のエンジンにおける用紙検知機構図である。

【図５】実施の形態１のプリンタエンジンにおける用紙検知回路図である。

【図６】実施の形態１のセンサ出力シーケンス図である。

【図７】本発明の実施の形態２のセンサ出力シーケンス図である。

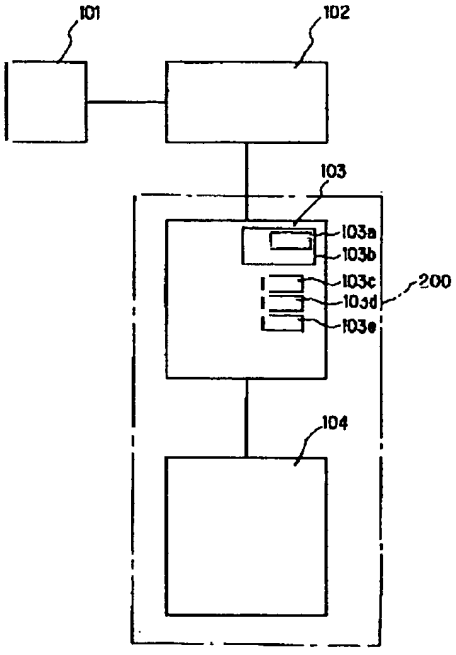
【図８】実施の形態１のフローチャート図。

【図９】実施の形態２のフローチャート図。

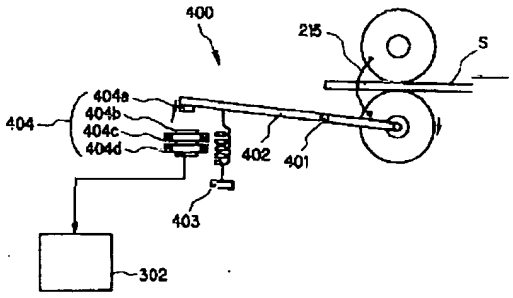
【符号の説明】

１０１　ディスプレイ
１０２　コンピュータ
１０３　プリンタコントローラ
１０４　プリンタエンジン
２０１　プリンタ本体
２０２　オプション給紙装置
２１５　レジストローラ対
３１５　紙厚検知回路
４０４　トランス
４０４ａ　可動コア
４０４ｂ　コア
４０４ｃ　１次巻線
４０４ｄ　２次巻線
５０１　発振器
５０２　検波回路
５０３　増幅器

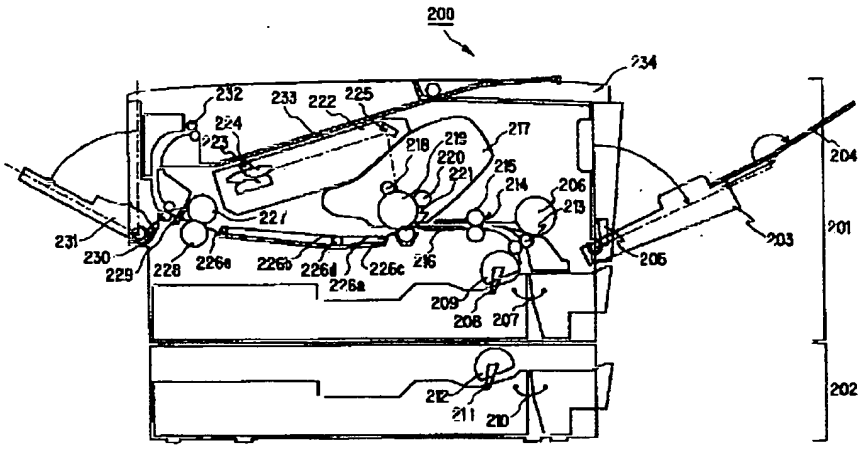
【図１】



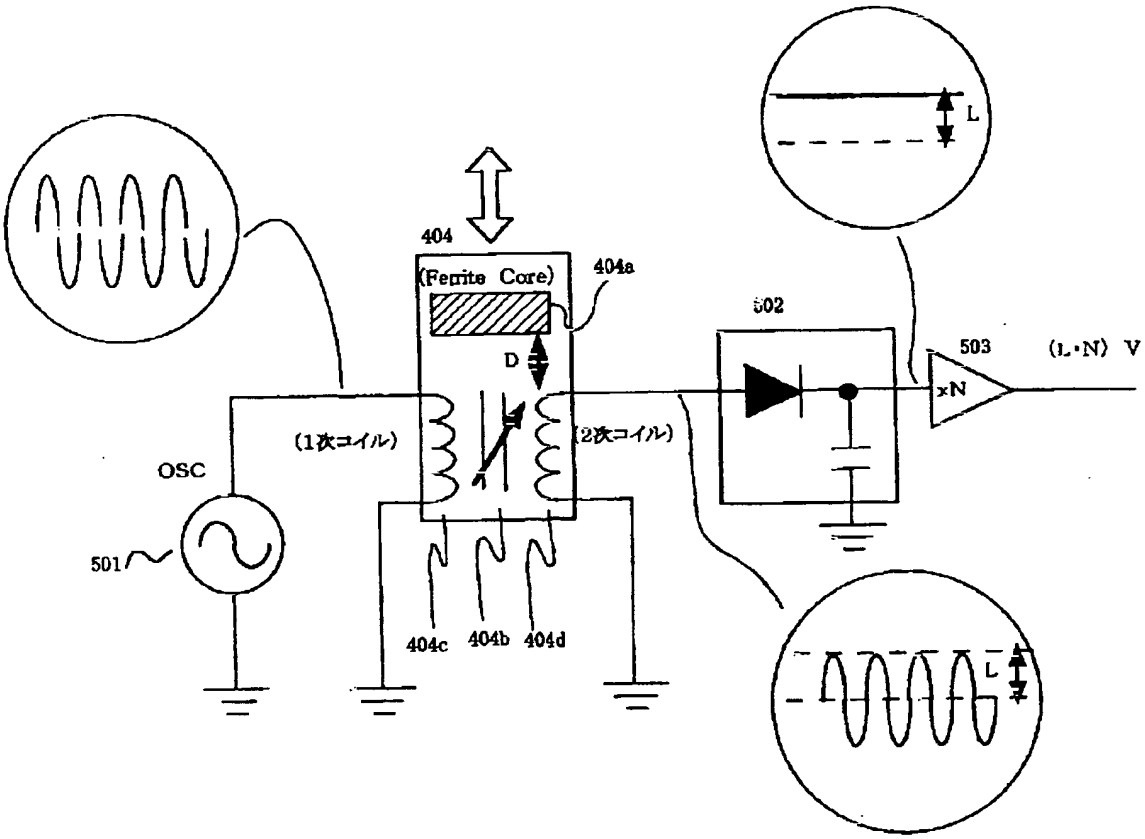
【図４】



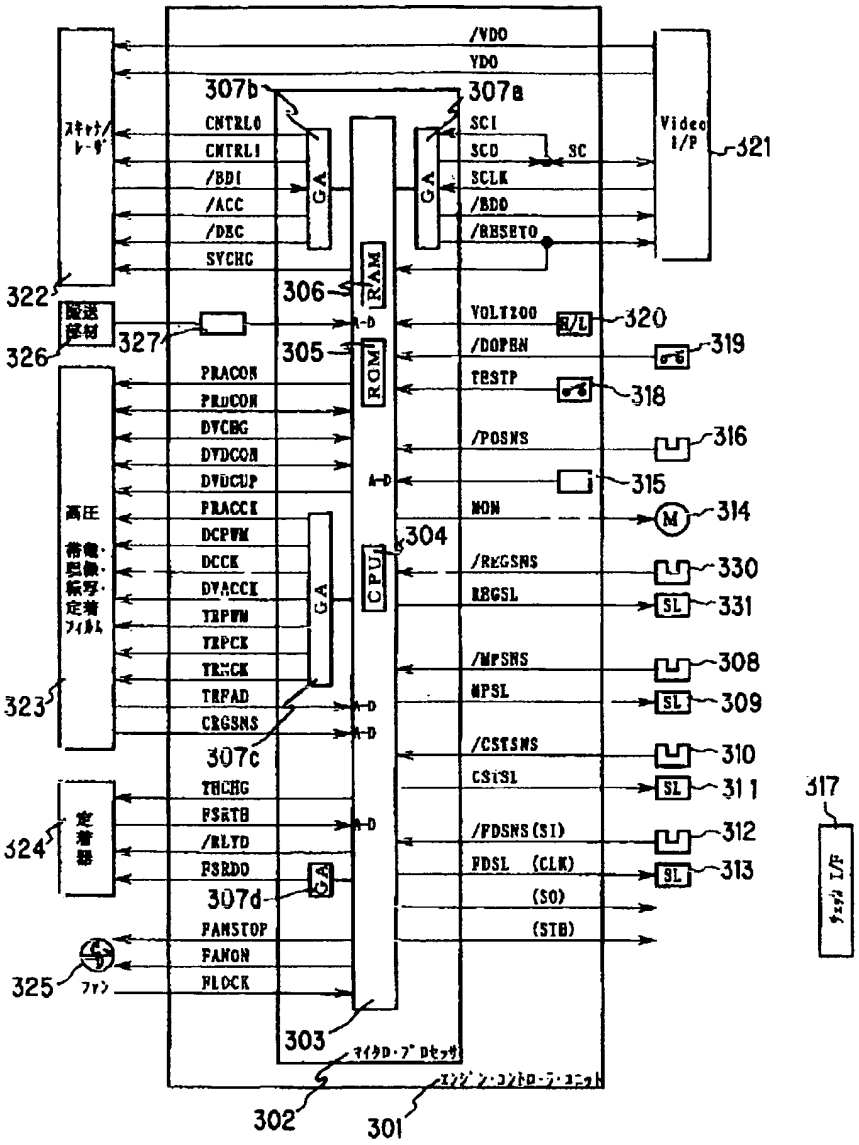
【図2】


200
234
232
233
222
225
224
223
218
219
220
221
217
215
214
206
213
204
201
203
205
231
230
229
228
226a
226b
226d
226c
216
226a
209
208
207
212
211
210
202

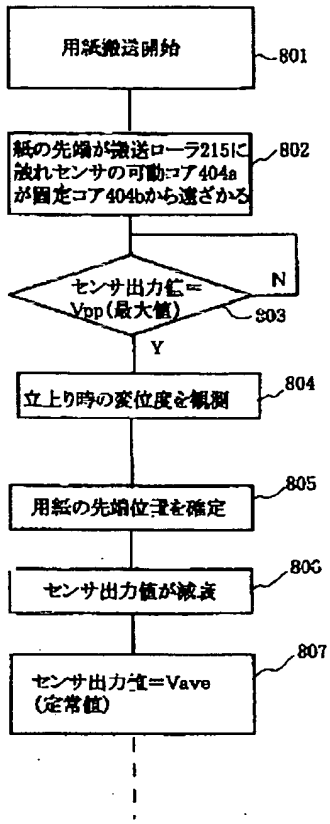
【図5】


L
404
(Ferrite Core)
404a
D
502
503
(L•N) V
×N
(1次コイル)
(2次コイル)
OSC
501
404c
404b
404d
L

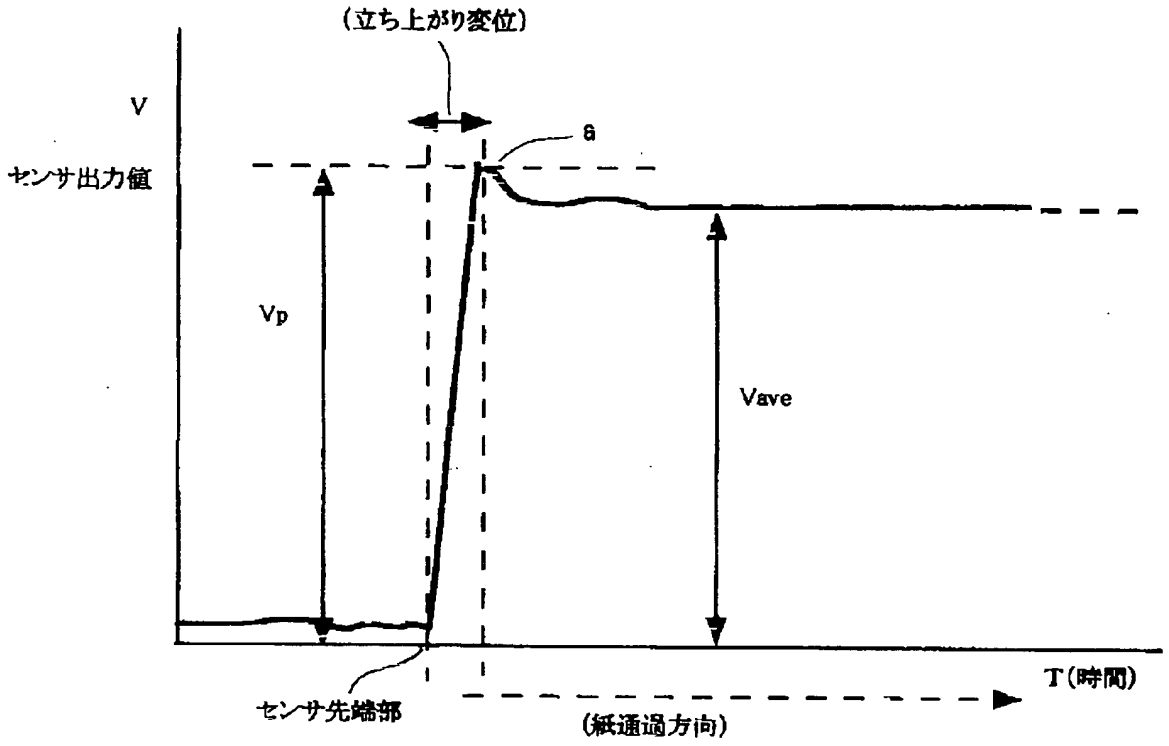
【図3】


/VDO
VDO
307b
307a
CNTRL0
CNTRL1
/BDI
/ACC
/DEC
SYCHG
SCI
SCO
SC
SCLK
/BDO
/RESETO
Video I/F
321
322
306
RAM
ROM
305
327
326
VOLTZOO
B/L
320
/DOPEN
319
TESTP
318
/POSNS
316
315
MON
314
304
CPU
/REGSNS
330
REGSL
331
/MPSNS
308
MPSL
309
/CSTSNS
310
CSTSL
311
/FDSNS(SI)
312
FDSL (CLK)
313
(SO)
(STB)
317
PRACON
PRDCON
DVCHG
DVDCON
DVDCUP
PRACCK
DCPWM
DCCK
DVACCK
TRPWM
TRPCK
TRNCK
TRPAD
CRGSNS
307c
THCHG
FSRTH
/RLYD
FSRDO
307d
FANSTOP
FANON
FLOCK
325
303
302
301
323
324
GA

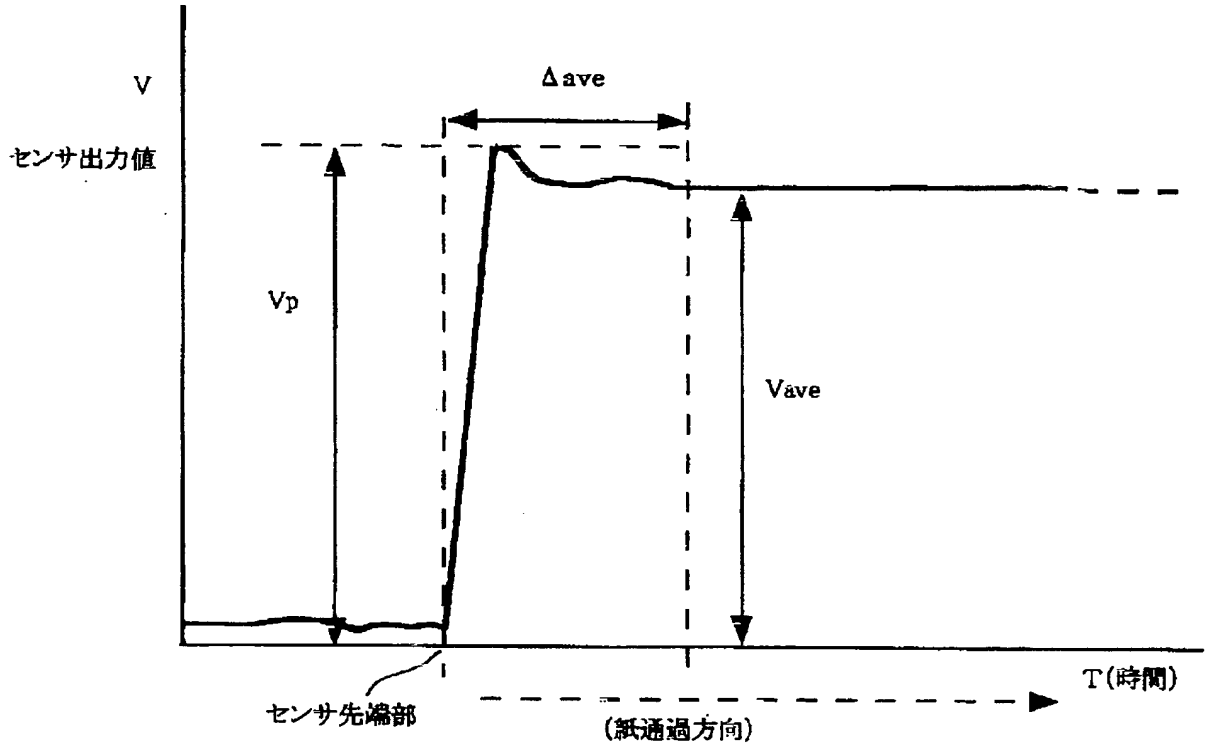
【図8】


用紙搬送開始
801
紙の先端が搬送ローラ215に
抜けセンサの可動コア404a
が固定コア404bから遠ざかる
802
センサ出力値=
Vpp(最大値)
803
N
Y
立上り時の変位度を観測
804
用紙の先端位置を確定
805
センサ出力値が減衰
806
センサ出力値=Vave
(定常値)
807

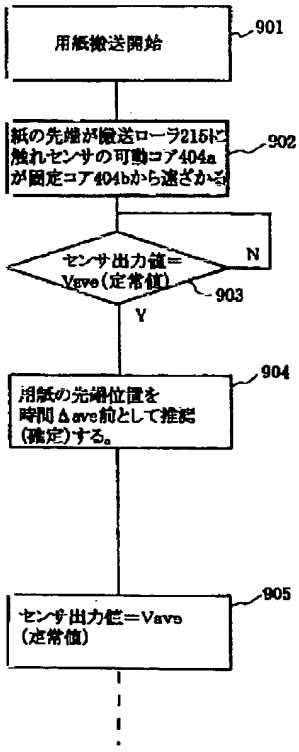
【図6】



【図7】


V
センサ出力値
Δave
Vp
Vave
T(時間)
センサ先端部
(紙通過方向)

【図9】


用紙搬送開始
901
紙の先端が搬送ローラ215に
触れセンサの可動コア404a
が固定コア404bから遠ざかる
902
センサ出力値=
Vave(定常値)
903
N
Y
用紙の先端位置を
時間Δave前として推測
(確定)する。
904
センサ出力値=Vave
(定常値)
905

フロントページの続き

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GG77 HH30 JJ02 JJ13 JJ22
MM04 MM17 PP06
3F048 AA01 AB01 BA20 BA21 BB07
CA02 CA09 CC03 DA06 DC04
EB24
3F049 AA02 DA12 LA01 LB03

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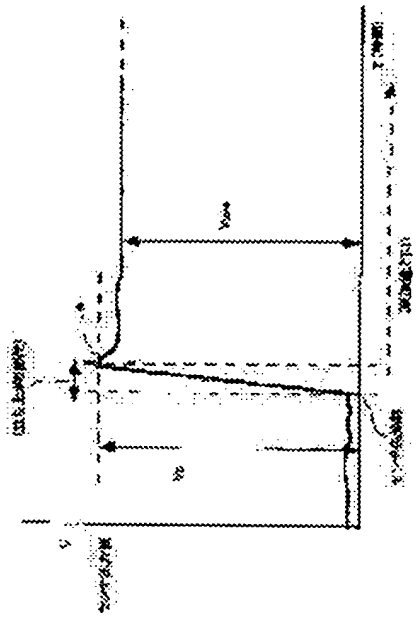
(71)Applicant : **CANON INC**
(72)Inventor : **ISHII TETSUYA**

(54) PAPER THICKNESS DETECTING DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a paper thickness detecting device to serve as both a paper thickness sensor and a forward end sensor by providing a function to detect not only the thickness of a paper sheet but also the forward end of the paper sheet.
SOLUTION: The paper thickness detecting device comprises the paper thickness sensor 400 to detect a paper thickness by detecting a roller distance between transport roller pair 251 to transport the paper sheets with the paper sheet nipped therebetween and detect a paper thickness, and a forward end discriminating means 302 to discriminate the forward end of the paper sheet from the output state of the paper thickness sensor 400 generated when the forward end of the paper sheet is brought into contact with the transport roller pair 251.



LEGAL STATUS

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[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

CLAIMS

[Claim(s)]
[Claim 1] Thickness-of-paper detection equipment characterized by having a tip distinction means to distinguish the tip of a form from the output state of the thickness-of-paper sensor which detects roller spacing of a conveyance roller pair conveyed on both sides of a form, and detects thickness of paper, and said thickness-of-paper sensor generated when a form tip touches said conveyance roller pair.
[Claim 2] A tip distinction means is thickness-of-paper detection equipment according to claim 1 characterized by reading whenever [displacement / of an output], or, overshoot as an output state of said thickness-of-paper sensor, and distinguishing the tip of a form.
[Claim 3] A tip distinction means is thickness-of-paper detection equipment according to claim 1 characterized by reading the moment of shifting to the steady state of the output level of said sensor as an output state of said thickness-of-paper sensor, and distinguishing the tip of a form.
[Claim 4] Thickness-of-paper detection equipment given in claim 1 characterized by having a interlocking means for the sensor of an alignment method from which a mutual inductance changes and an output changes to be used, and to interlock and to carry out the variation rate of said movable core to change of roller spacing of a conveyance roller pair with the distance of a fixed core and a movable core as a thickness-of-paper sensor thru/or one term of 3.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the thickness-of-paper detection equipment for detecting the thickness of paper which will be adopted as image formation equipment etc. from now on.
[0002]
[Description of the Prior Art] Conventionally, this kind of thickness-of-paper sensor had taken the configuration of only the function which detects thickness of paper.
[0003]
[Problem(s) to be Solved by the Invention] However, in the above-mentioned conventional example, the part to which a thickness-of-paper sensor is added, a cost rise factor, and the difficulty [an installation location] of reservation increase.
[0004] By giving the tip detection function of not only the thickness of paper of a form but a form, the place which it was made in order that this invention might solve the problem of the above-mentioned conventional technique, and is made into the purpose offers the thickness-of-paper detection equipment a thickness-of-paper sensor and a tip sensor may be made to use also [equipment], and is shown in attaining cost cut and space-saving-ization.
[0005]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, according to this invention, it is characterized by having a tip distinction means to distinguish the tip of a form from the output state of the thickness-of-paper sensor which detects roller spacing of a conveyance roller pair conveyed on both sides of a form, and

detects thickness of paper, and said thickness-of-paper sensor generated when a form tip touches said conveyance roller pair.
[0006] That is, the function which detects the tip of not only thickness of paper but a form is given by using the stability of whenever [displacement / of the sensor output value generated according to counteraction of the sensor installation supporter material generated the moment the form tip passed the thickness-of-paper sensor etc.], overshoot, or the convergence time amount converged on the steady state of an output level.
[0007] It is suitable to consider as a configuration equipped with a interlocking means to interlock and to carry out the variation rate of the movable core to change of roller spacing of a conveyance roller pair using the sensor of an alignment method from which a mutual inductance changes and an output changes with the distance of a fixed core and a movable core as a thickness-of-paper sensor.
[0008]
[Embodiment of the Invention] This invention is explained at a detail based on the gestalt of implementation of illustration below.
[0009] (Gestalt 1 of operation) Drawing 1 shows the block diagram of the printer 200 as image formation equipment containing the printer controller 103 and printer engine 104 with which the thickness-of-paper detection equipment of the gestalt 1 of operation of this invention is used.
[0010] As for 101, a display and 102 are host computers among drawing. 103 is a printer controller, and to be able to carry out the raster scan of the image data transmitted from the host computer 102, it changes into a picture signal or it controls printer engine 104 through an interface. Both a printer controller 103 and the printer engine 104 are stored in the same printer case.
[0011] Each part in a printer controller 103 is as follows.
[0012] The display by which 103a is arranged on a printer case front face, the control unit by which 103b is also arranged on a printer case front face, and 103c are [ROM in CPU103c and 103e of Controller CPU and 103d] RAM in CPU103c.
[0013] Drawing 2 is the machine configuration Fig. of a printer 200.
[0014] This printer 200 consists of a body 201 of a printer which is a body part, and option feeding equipment 202 which is an option.
[0015] 203 is a frame front cover, and if this is opened, it can use MPT (Multi-Purpose Tray)204 which is a manual paper feed tray. 205 is the flag of the sensor which detects those with a form on the above-mentioned manual paper feed tray (MPT) 204. 206 is a feed roller for conveying the form on the manual paper feed tray (MPT) 204 inside a printer.
[0016] PCT (Paper Cassette Tray) whose 207 is a standard medium tray it is . 208 is the flag of the sensor which detects those with a form on the standard medium tray (PCT) 207. 209 is a feed roller for conveying the form on the standard medium tray (PCT) 207 inside a printer.
[0017] 210 is OPT (Optional Paper cassette Tray) which is an option medium tray. 211 is the flag of the sensor which detects those with a form on the option tray (OPT) 210. 212 is an OPT feeding roller for conveying the form on the option tray (OPT) 210 inside a printer.
[0018] 213 is a roller for conveying further the form to which paper was fed from the standard medium tray (PCT) 207 and the option medium tray (OPT) 210 inside a printer.
[0019] the manual paper feed tray (MPT) 204, the standard medium tray (PCT) 207, and the option medium tray (OPT) 210 -- the form to which paper was fed from either contacts the resist shutter 214 in a tip, and has the sense of conveyance corrected

Furthermore, a form is further conveyed back by the drive of resist roller pair 215. A form is further led to the imprint nip pinched with a photoconductor drum 219 and the imprint roller 221 with the conveyance guide 216.
[0020] 217 is a well-known toner cartridge and equips the interior with the primary electrification roller 218, a photoconductor drum 219, and the development cylinder 220.
[0021] The writing of an electrostatic latent image is made by irradiating the polygon mirror 224 by which a rotation drive is carried out by the motor 223, and irradiating a predetermined laser beam to a photoconductor drum 219 by the clinch mirror 225 in the scanner unit 222.
[0022] After a form passes a toner imprint location, it is conveyed according to the conveyance belt devices 226a-226e by the fixing assembly which consists of a fixing roller 227 and a pressurization roller 228, and a form is fixed to a toner image here.
[0023] 229 is a delivery sensor and detects existence of the form just behind a fixing assembly.
[0024] The form which passed the fixing assembly is further conveyed with the delivery roller 230. If the face-up tray 231 is open as shown in drawing, a form will be loaded on a tray 231. Moreover, if the tray 231 has closed, a form will reach a roller 232 and will be loaded on the face down tray 233.
[0025] 234 is an upper door, and if this is opened upward, it can perform receipts and payments of a toner cartridge 217.
[0026] Drawing 3 is the electric block diagram of the printer engine 104 of the gestalt 1 of operation.
[0027] 301 is the electrical circuit unit of printer engine 104. 302 is a microprocessor and 303 is the core. The microprocessor 302 is equipped with CPU304, ROM305 and RAM306 which are prepared in the core 303 interior, and the gate arrays (Gate Array) (it omits Following GA) 307a-307d connected with a core 303.
[0028] 308 -- the sensor with a form of the manual paper feed tray (MPT) 204, and 309 -- for the feed roller drive solenoid of the standard medium tray (PCT) 207, and 312, as for the feed roller drive solenoid of the option medium tray (OPT) 210, and 330, the sensor with a form of the option medium tray (OPT) 210 and 313 are [the feed roller drive solenoid of the manual paper feed tray (MPT) 204, and 310 / the sensor with a form of the standard medium tray (PCT) 207, and 311 / the sensor before a resist and 331] resist roller drive solenoids. Each roller rotates by driving a solenoid during rotation of the Maine motor 314.
[0029] The thickness-of-paper detecting circuit where 315 detects the thickness of paper of a form, and 316 are the delivery sensors for detecting that paper was delivered to the form from the printer.
[0030] 317 is an interface with the checker connected to option feeding equipment and an exclusion target at the body of a printer. As for this checker, a service person in charge is used for the situation check of a printer, or predetermined actuation.
[0031] 318 is a switch for the test print directions for making a test image output for the check of a printer of operation. 319 is a switch for detecting the switching condition of a door 234 and turning off the high-tension circuit inside a printer in the state of open. 320 is a jumper which directs the type of the power source of this printer.
[0032] 321 is an external interface circuitry for printer engine 104 to communicate with a printer controller 103. The electrical circuit where 322 controls the electrical circuit of the scanner unit 222, and 323 controls the high pressure of electrification, development, an imprint, and a fixing film, and 324 are the electrical circuits of a fixing assembly.
[0033] 325 is a fan for cooling the interior of a printer.

[0034] 326 is conveyance members, such as the conveyance guide 216 of a form, and the conveyance belts 226a-226e, and 327 is an input circuit for inputting the potential of the conveyance guide 216 into the core 303 of a microprocessor.
[0035] Printer engine 104 is put on /BDO to a controller 103 through an external interface (I/F), and outputs BD signal. Although the polygon mirror 224 is the signal which shows that it is a predetermined phase, this is the synchronizing signal of a horizontal scanning line, when performing image formation actuation to each form and receiving the image of one frame in the shape of a raster through VDO/VDO. Moreover, the first BD signal over each frame is called the TOP signal.
[0036] Drawing 4 shows the configuration of the thickness-of-paper detection equipment in the printer of the gestalt 1 of this operation. It is what shows the place where Form S has advanced into 215 from the space right. the resist roller pair as a conveyance roller pair which conveys this drawing on both sides of a form -- The thickness-of-paper sensor 400 which detects roller spacing of resist roller pair 215, and detects thickness of paper, a form tip -- a resist roller pair -- it has the microprocessor 302 as a tip distinction means to distinguish the tip of Form S from the output state of said thickness-of-paper sensor 400 generated when 215 is touched.
[0037] the sensor of an alignment method from which a mutual inductance changes and an output changes with the distance of fixed core 404b and movable core 404a as a thickness-of-paper sensor 400 uses -- having -- said movable core 404a -- a resist roller pair -- it has the supporter material 402 as a interlocking means which it interlocks and carries out a variation rate to change of roller spacing of 215. this supporter material 402 is supported free [rotation] to a revolving shaft 401 -- having -- that end -- a resist roller pair -- one roller of 215 is supported and movable core 404a is supported by the other end.
[0038] The above-mentioned transformer 404 forms one core which shares primary coil 404c and 404d of secondary coils by movable core 404a and fixed core 404b. With the distance of movable core 404a and fixed core 404b, the mutual inductance between primary coil 404c and 404d of secondary coils becomes settled.
[0039] If Form S advances, the roller of the resist roller pair 215 bottom will fall by the thickness of Form S, and the supporter material 402 will rotate to a space clockwise rotation centering on a revolving shaft 401. this supporter material 402 is energized to a space counterclockwise rotation according to the spring device 403 -- having -- a resist roller pair -- it is energized in the direction in which 215 contacts.
[0040] Drawing 5 is the internal circuitry of the thickness-of-paper detection equipment in explanation of drawing 4 . Explanation in this circuit is given to below.
[0041] In drawing 5 , 501 is an oscillator always impressed to primary coil 404c, and it oscillates because a current flows to a primary side coil at 404c. On the other hand, the mutual inductance of a coil 404 is determined according to the distance D with the flight cores 404a and 404b, and the alternating current pulse value generated in 404d of secondary coils according to this is determined. For example, if L which is said alternating current pulse-voltage value will become low if the distance of D is short, and the distance of D becomes large conversely, it has the relation that the value of L becomes high. Moreover, as for the relation between D (distance) and L (electrical-potential-difference value), linearity is maintained mostly.
[0042] And shape peak value L of this alternating current pulse value in waveform by the detector circuit 502, change into a direct-current-voltage value, and that output is made to amplify N times with amplifier 503, and let this output value (L-N) be the print-out of final thickness of paper.

[0043] In the equipment of a configuration of that the thickness-of-paper sensor 400 stated above is carried, it explains using the sequence diagram of drawing 6 , and the flow chart Fig. of drawing 8 .
[0044] If printing control instruction is sent and printing control is started, paper will be fed to the form included in the various medium trays MPT204, PCT207, and OPT210 with each feed roller 206,209,212, it will be further conveyed with the conveyance roller 213, and the sense of a form will be corrected by the resist shutter (801).
[0045] and the tip of a form -- a resist roller pair -- if 215 is touched, the supporter material 402 will move [said both ends of resist roller pair 215] counterclockwise centering on breadth and a revolving shaft 401 in an instant, and movable core 404a attached at the tip will keep away from fixed core 404b (802).
[0046] the output (503) of a thickness-of-paper sensor was shown by drawing 6 at this moment -- it starts, the variation rate at the time and overshoot like a points occur, and peak value (****) is detected (803). Furthermore, also whenever [this displacement / that was detected / at this time] is observed (804).
[0047] And the time amount of whenever [displacement / which starts] is read by CPU302, and said CPU302 distinguishes peak value (****) as a tip detection signal of a form based on such information by incorporating in A/D converter 303 in which the electrical-potential-difference value of the thickness-of-paper detecting circuit 315 is carried in CPU302 (805).
[0048] And if conveyed continuously, while the output value of the thickness-of-paper sensor 400 will decline (806), an output value is a stationary value (Vave). It is stabilized (807).
[0049] (Gestalt 2 of operation) In the equipment of a configuration of that the thickness-of-paper sensor 400 stated to drawing 1 - drawing 5 is carried, the gestalt 2 of operation is explained using the sequence diagram of drawing 7 , and the flow chart Fig. of drawing 9 .
[0050] With the gestalt 2 of this operation, CPU302 as a tip distinction means reads the moment of shifting to the steady state of the output level of a sensor as an output state of said thickness-of-paper sensor 400, and distinguishes the tip of a form.
[0051] That is, if printing control instruction is sent and printing control is started, paper will be fed to the form included in the various medium trays MPT204, PCT207, and OPT210 with each feed roller 206,209,212, it will be further conveyed with the conveyance roller 213, and the sense will be corrected by paper with a resist shutter (901).
[0052] and the tip of paper -- a resist roller pair -- if 215 is touched, the directions member 402 will move [said both ends of resist roller pair 215] to a half-clockwise rotation centering on breadth and a revolving shaft 401 in an instant, and movable core 404a attached at the tip will keep away from fixed core 404b (902).
[0053] if overshoot like a points shown by drawing 7 in the output (503) of a sensor occurs and it is continuously conveyed at this moment -- the fixed time amount back (deltaave) **** -- an output value -- stationary value (Vave) It is stabilized (903).
[0054] The electrical-potential-difference value 503 of the thickness-of-paper detecting circuit 315 when being stabilized in this stationary value is incorporated in A/D converter 303 in which it is carried in CPU302. This deltaave It is deltaave after converging CPU302, since time amount until it reaches (convergence) becomes almost fixed. The tip location of a form guesses the sequence which passes a transformer 404 by what (904) it goes back and the time amount of a part is distinguished for as a tip location of a form.
[0055]

[Effect of the Invention] Whenever [displacement / at the time of the standup of the sensor output value generated according to counteraction of the sensor installation supporter material which is generated according to this invention the moment the form passed the thickness-of-paper sensor as explained above etc.], and overshoot, since it constituted so that the tip of paper might be detected by using the output state of the stability of the convergence time amount converged on a stationary value, even a thickness-of-paper detection sensor can come out, a tip detection sensor can be made to serve a double purpose, and it becomes realizable [a cost cut and space-saving-izing of the installation location of a sensor].

TECHNICAL FIELD

[Field of the Invention] This invention relates to the thickness-of-paper detection equipment for detecting the thickness of paper which will be adopted as image formation equipment etc. from now on.

PRIOR ART

[Description of the Prior Art] Conventionally, this kind of thickness-of-paper sensor had taken the configuration of only the function which detects thickness of paper.

EFFECT OF THE INVENTION

[Effect of the Invention] Whenever [displacement / at the time of the standup of the sensor output value generated according to counteraction of the sensor installation supporter material which is generated according to this invention the moment the form passed the thickness-of-paper sensor as explained above etc.], and overshoot, since it constituted so that the tip of paper might be detected by using the output state of the stability of the convergence time amount converged on a stationary value, even a thickness-of-paper detection sensor can come out, a tip detection sensor can be made to serve a double purpose, and it becomes realizable [a cost cut and space-saving-izing of the installation location of a sensor].

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, in the above-mentioned conventional example, the part to which a thickness-of-paper sensor is added, a cost rise factor, and the difficulty [an installation location] of reservation increase.
[0004] By giving the tip detection function of not only the thickness of paper of a form but a form, the place which it was made in order that this invention might solve the problem of the above-mentioned conventional technique, and is made into the purpose offers the thickness-of-paper detection equipment a thickness-of-paper sensor and a tip sensor may be made to use also [equipment], and is shown in attaining cost cut and space-saving-ization.

MEANS

[Means for Solving the Problem] In order to attain the above-mentioned purpose, according to this invention, it is characterized by having a tip distinction means to

distinguish the tip of a form from the output state of the thickness-of-paper sensor which detects roller spacing of a conveyance roller pair conveyed on both sides of a form, and detects thickness of paper, and said thickness-of-paper sensor generated when a form tip touches said conveyance roller pair.
[0006] That is, the function which detects the tip of not only thickness of paper but a form is given by using the stability of whenever [displacement / of the sensor output value generated according to counteraction of the sensor installation supporter material generated the moment the form tip passed the thickness-of-paper sensor etc.], overshoot, or the convergence time amount converged on the steady state of an output level.
[0007] It is suitable to consider as a configuration equipped with a interlocking means to interlock and to carry out the variation rate of the movable core to change of roller spacing of a conveyance roller pair using the sensor of an alignment method from which a mutual inductance changes and an output changes with the distance of a fixed core and a movable core as a thickness-of-paper sensor.
[0008]
[Embodiment of the Invention] This invention is explained at a detail based on the gestalt of implementation of illustration below.
[0009] (Gestalt 1 of operation) Drawing 1 shows the block diagram of the printer 200 as image formation equipment containing the printer controller 103 and printer engine 104 with which the thickness-of-paper detection equipment of the gestalt 1 of operation of this invention is used.
[0010] As for 101, a display and 102 are host computers among drawing. 103 is a printer controller, and to be able to carry out the raster scan of the image data transmitted from the host computer 102, it changes into a picture signal or it controls printer engine 104 through an interface. Both a printer controller 103 and the printer engine 104 are stored in the same printer case.
[0011] Each part in a printer controller 103 is as follows.
[0012] The display by which 103a is arranged on a printer case front face, the control unit by which 103b is also arranged on a printer case front face, and 103c are [ROM in CPU103c and 103e of Controller CPU and 103d] RAM in CPU103c.
[0013] Drawing 2 is the machine configuration Fig. of a printer 200.
[0014] This printer 200 consists of a body 201 of a printer which is a body part, and option feeding equipment 202 which is an option.
[0015] 203 is a frame front cover, and if this is opened, it can use MPT (Multi-Purpose Tray)204 which is a manual paper feed tray. 205 is the flag of the sensor which detects those with a form on the above-mentioned manual paper feed tray (MPT) 204. 206 is a feed roller for conveying the form on the manual paper feed tray (MPT) 204 inside a printer.
[0016] PCT (Paper Cassette Tray) whose 207 is a standard medium tray it is . 208 is the flag of the sensor which detects those with a form on the standard medium tray (PCT) 207. 209 is a feed roller for conveying the form on the standard medium tray (PCT) 207 inside a printer.
[0017] 210 is OPT (Optional Paper cassette Tray) which is an option medium tray. 211 is the flag of the sensor which detects those with a form on the option tray (OPT) 210. 212 is an OPT feeding roller for conveying the form on the option tray (OPT) 210 inside a printer.
[0018] 213 is a roller for conveying further the form to which paper was fed from the standard medium tray (PCT) 207 and the option medium tray (OPT) 210 inside a printer.
[0019] the manual paper feed tray (MPT) 204, the standard medium tray (PCT) 207, and

the option medium tray (OPT) 210 -- the form to which paper was fed from either contacts the resist shutter 214 in a tip, and has the sense of conveyance corrected Furthermore, a form is further conveyed back by the drive of resist roller pair 215. A form is further led to the imprint nip pinched with a photoconductor drum 219 and the imprint roller 221 with the conveyance guide 216.
[0020] 217 is a well-known toner cartridge and equips the interior with the primary electrification roller 218, a photoconductor drum 219, and the development cylinder 220.
[0021] The writing of an electrostatic latent image is made by irradiating the polygon mirror 224 by which a rotation drive is carried out by the motor 223, and irradiating a predetermined laser beam to a photoconductor drum 219 by the clinch mirror 225 in the scanner unit 222.
[0022] After a form passes a toner imprint location, it is conveyed according to the conveyance belt devices 226a-226e by the fixing assembly which consists of a fixing roller 227 and a pressurization roller 228, and a form is fixed to a toner image here.
[0023] 229 is a delivery sensor and detects existence of the form just behind a fixing assembly.
[0024] The form which passed the fixing assembly is further conveyed with the delivery roller 230. If the face-up tray 231 is open as shown in drawing, a form will be loaded on a tray 231. Moreover, if the tray 231 has closed, a form will reach a roller 232 and will be loaded on the face down tray 233.
[0025] 234 is an upper door, and if this is opened upward, it can perform receipts and payments of a toner cartridge 217.
[0026] Drawing 3 is the electric block diagram of the printer engine 104 of the gestalt 1 of operation.
[0027] 301 is the electrical circuit unit of printer engine 104. 302 is a microprocessor and 303 is the core. The microprocessor 302 is equipped with CPU304, ROM305 and RAM306 which are prepared in the core 303 interior, and the gate arrays (Gate Array) (it omits Following GA) 307a-307d connected with a core 303.
[0028] 308 -- the sensor with a form of the manual paper feed tray (MPT) 204, and 309 -- for the feed roller drive solenoid of the standard medium tray (PCT) 207, and 312, as for the feed roller drive solenoid of the option medium tray (OPT) 210, and 330, the sensor with a form of the option medium tray (OPT) 210 and 313 are [the feed roller drive solenoid of the manual paper feed tray (MPT) 204, and 310 / the sensor with a form of the standard medium tray (PCT) 207, and 311 / the sensor before a resist and 331] resist roller drive solenoids. Each roller rotates by driving a solenoid during rotation of the Maine motor 314.
[0029] The thickness-of-paper detecting circuit where 315 detects the thickness of paper of a form, and 316 are the delivery sensors for detecting that paper was delivered to the form from the printer.
[0030] 317 is an interface with the checker connected to option feeding equipment and an exclusion target at the body of a printer. As for this checker, a service person in charge is used for the situation check of a printer, or predetermined actuation.
[0031] 318 is a switch for the test print directions for making a test image output for the check of a printer of operation. 319 is a switch for detecting the switching condition of a door 234 and turning off the high-tension circuit inside a printer in the state of open. 320 is a jumper which directs the type of the power source of this printer.
[0032] 321 is an external interface circuitry for printer engine 104 to communicate with a printer controller 103. The electrical circuit where 322 controls the electrical circuit of the scanner unit 222, and 323 controls the high pressure of electrification, development, an

imprint, and a fixing film, and 324 are the electrical circuits of a fixing assembly.
[0033] 325 is a fan for cooling the interior of a printer.
[0034] 326 is conveyance members, such as the conveyance guide 216 of a form, and the conveyance belts 226a-226e, and 327 is an input circuit for inputting the potential of the conveyance guide 216 into the core 303 of a microprocessor.
[0035] Printer engine 104 is put on /BDO to a controller 103 through an external interface (I/F), and outputs BD signal. Although the polygon mirror 224 is the signal which shows that it is a predetermined phase, this is the synchronizing signal of a horizontal scanning line, when performing image formation actuation to each form and receiving the image of one frame in the shape of a raster through VDO/VDO. Moreover, the first BD signal over each frame is called the TOP signal.
[0036] Drawing 4 shows the configuration of the thickness-of-paper detection equipment in the printer of the gestalt 1 of this operation. It is what shows the place where Form S has advanced into 215 from the space right. the resist roller pair as a conveyance roller pair which conveys this drawing on both sides of a form -- The thickness-of-paper sensor 400 which detects roller spacing of resist roller pair 215, and detects thickness of paper, a form tip -- a resist roller pair -- it has the microprocessor 302 as a tip distinction means to distinguish the tip of Form S from the output state of said thickness-of-paper sensor 400 generated when 215 is touched.
[0037] the sensor of an alignment method from which a mutual inductance changes and an output changes with the distance of fixed core 404b and movable core 404a as a thickness-of-paper sensor 400 uses -- having -- said movable core 404a -- a resist roller pair -- it has the supporter material 402 as a interlocking means which it interlocks and carries out a variation rate to change of roller spacing of 215. this supporter material 402 is supported free [rotation] to a revolving shaft 401 -- having -- that end -- a resist roller pair -- one roller of 215 is supported and movable core 404a is supported by the other end.
[0038] The above-mentioned transformer 404 forms one core which shares primary coil 404c and 404d of secondary coils by movable core 404a and fixed core 404b. With the distance of movable core 404a and fixed core 404b, the mutual inductance between primary coil 404c and 404d of secondary coils becomes settled.
[0039] If Form S advances, the roller of the resist roller pair 215 bottom will fall by the thickness of Form S, and the supporter material 402 will rotate to a space clockwise rotation centering on a revolving shaft 401. this supporter material 402 is energized to a space counterclockwise rotation according to the spring device 403 -- having -- a resist roller pair -- it is energized in the direction in which 215 contacts.
[0040] Drawing 5 is the internal circuitry of the thickness-of-paper detection equipment in explanation of drawing 4 . Explanation in this circuit is given to below.
[0041] In drawing 5 , 501 is an oscillator always impressed to primary coil 404c, and it oscillates because a current flows to a primary side coil at 404c. On the other hand, the mutual inductance of a coil 404 is determined according to the distance D with the flight cores 404a and 404b, and the alternating current pulse value generated in 404d of secondary coils according to this is determined. For example, if L which is said alternating current pulse-voltage value will become low if the distance of D is short, and the distance of D becomes large conversely, it has the relation that the value of L becomes high. Moreover, as for the relation between D (distance) and L (electrical-potential-difference value), linearity is maintained mostly.
[0042] And shape peak value L of this alternating current pulse value in waveform by the detector circuit 502, change into a direct-current-voltage value, and that output is made to

amplify N times with amplifier 503, and let this output value (L-N) be the print-out of final thickness of paper.
[0043] In the equipment of a configuration of that the thickness-of-paper sensor 400 stated above is carried, it explains using the sequence diagram of drawing 6 , and the flow chart Fig. of drawing 8 .
[0044] If printing control instruction is sent and printing control is started, paper will be fed to the form included in the various medium trays MPT204, PCT207, and OPT210 with each feed roller 206,209,212, it will be further conveyed with the conveyance roller 213, and the sense of a form will be corrected by the resist shutter (801).
[0045] and the tip of a form -- a resist roller pair -- if 215 is touched, the supporter material 402 will move [said both ends of resist roller pair 215] counterclockwise centering on breadth and a revolving shaft 401 in an instant, and movable core 404a attached at the tip will keep away from fixed core 404b (802).
[0046] the output (503) of a thickness-of-paper sensor was shown by drawing 6 at this moment -- it starts, the variation rate at the time and overshoot like a points occur, and peak value (****) is detected (803). Furthermore, also whenever [this displacement / that was detected / at this time] is observed (804).
[0047] And the time amount of whenever [displacement / which starts] is read by CPU302, and said CPU302 distinguishes peak value (****) as a tip detection signal of a form based on such information by incorporating in A/D converter 303 in which the electrical-potential-difference value of the thickness-of-paper detecting circuit 315 is carried in CPU302 (805).
[0048] And if conveyed continuously, while the output value of the thickness-of-paper sensor 400 will decline (806), an output value is a stationary value (Vave). It is stabilized (807).
[0049] (Gestalt 2 of operation) In the equipment of a configuration of that the thickness-of-paper sensor 400 stated to drawing 1 - drawing 5 is carried, the gestalt 2 of operation is explained using the sequence diagram of drawing 7 , and the flow chart Fig. of drawing 9 .
[0050] With the gestalt 2 of this operation, CPU302 as a tip distinction means reads the moment of shifting to the steady state of the output level of a sensor as an output state of said thickness-of-paper sensor 400, and distinguishes the tip of a form.
[0051] That is, if printing control instruction is sent and printing control is started, paper will be fed to the form included in the various medium trays MPT204, PCT207, and OPT210 with each feed roller 206,209,212, it will be further conveyed with the conveyance roller 213, and the sense will be corrected by paper with a resist shutter (901).
[0052] and the tip of paper -- a resist roller pair -- if 215 is touched, the directions member 402 will move [said both ends of resist roller pair 215] to a half-clockwise rotation centering on breadth and a revolving shaft 401 in an instant, and movable core 404a attached at the tip will keep away from fixed core 404b (902).
[0053] if overshoot like a points shown by drawing 7 in the output (503) of a sensor occurs and it is continuously conveyed at this moment -- the fixed time amount back (deltaave) **** -- an output value -- stationary value (Vave) It is stabilized (903).
[0054] The electrical-potential-difference value 503 of the thickness-of-paper detecting circuit 315 when being stabilized in this stationary value is incorporated in A/D converter 303 in which it is carried in CPU302. This deltaave It is deltaave after converging CPU302, since time amount until it reaches (convergence) becomes almost fixed. The tip location of a form guesses the sequence which passes a transformer 404 by what (904) it

goes back and the time amount of a part is distinguished for as a tip location of a form.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram of the printer system as image formation equipment containing the printer controller and printer engine concerning the gestalt 1 of operation of this invention.
[Drawing 2] It is the machine configuration Fig. of the printer engine of the gestalt 1 of operation.
[Drawing 3] It is the electric block diagram of the printer engine of the gestalt 1 of operation.
[Drawing 4] It is the form detector composition in the engine of the gestalt 1 of operation.
[Drawing 5] It is a form detecting circuit Fig. in the printer engine of the gestalt 1 of operation.
[Drawing 6] It is the sensor output sequence diagram of the gestalt 1 of operation.
[Drawing 7] It is the sensor output sequence diagram of the gestalt 2 of operation of this invention.
[Drawing 8] The flow chart Fig. of the gestalt 1 of operation.
[Drawing 9] The flow chart Fig. of the gestalt 2 of operation.
[Description of Notations]
101 Display
102 Computer
103 Printer Controller
104 Printer Engine
201 Body of Printer
202 Option Feeding Equipment
215 Resist Roller Pair
315 Thickness-of-Paper Detecting Circuit
404 Transformer
404a Movable core
404b Core
404c Primary coil
404d Secondary coil
501 Oscillator
502 Detector Circuit
503 Amplifier